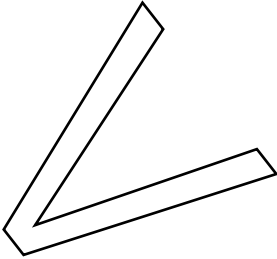


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Vervangt NEN-EU 155:1986; NEN-EN 10155 1991 Ontw.

Nederlandse norm

# **NEN-EN 10155** (en)

Weervast constructiestaal - Technische leveringsvoorwaarden

Structural steels with improved atmospheric corrosion resistance - Technical delivery conditions

ICS 77 140.50, 91.080.10-10  
oktober 1993

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- EN 10155:1993, DT

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Normcommissie 342 050 "Constructiestaal"

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English version

## Structural steels with improved atmospheric corrosion resistance — Technical delivery conditions

Aciers de construction à résistance améliorée  
à la corrosion atmosphérique — Conditions  
techniques de livraison

Wetterfeste Baustähle — Technische  
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Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

## Foreword

This European Standard has been drawn up by ECISS/TC 10 'Structural steel - qualities' whose secretariat is held by NNI.

This European Standard replaces EURONORM 155-80 *Weathering steels for structural purposes - Quality standard*.

ECISS/TC 10 met 26 and 27 September 1991 in Brussels and agreed on the text for circulation for formal vote within CEN. The following countries were represented in that meeting: Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Sweden and United Kingdom.

This Standard was approved by CEN as a European Standard.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 1993, and conflicting national standards shall be withdrawn at the latest by December 1993.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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## 1 Scope

1.1 This European Standard specifies requirements for long products and flat products of hot-rolled steels with improved atmospheric corrosion resistance (alloyed special steel according to EN 10020) in the grades and qualities given in tables 3 (chemical composition), 5 and 6 (mechanical properties) in the usual delivery condition as given in 7.2.

The thicknesses in which products of the steel grades and qualities specified in this European Standard may be supplied are given in table 2. The application of this standard to greater thicknesses shall be agreed at the time of the enquiry and order.

Option 1.

The steels specified in this European Standard are intended for use in welded, bolted and riveted components which shall have enhanced resistance to atmospheric corrosion, for service at ambient temperatures (subject to the restrictions described in 7.5.1).

They are not intended to be heat treated except products delivered in the delivery condition N. Stress relief annealing is permitted. Products delivered in the N condition may be normalized and hot formed after delivery (see clause 3).

1.2 This European Standard does not apply to structural steels for use in the applications referred to in 1.1 for which specific Euronorms exist or European Standards dealing with steels for general structural applications are being prepared:

- non-alloy structural steels - (see EN 10025);
- steels for simple pressure vessels - (see EN 10207);
- non-alloy steel sheet and strip for pressure purposes - (see EN 10028 Parts 1 to 3);
- reinforcing bars (not for prestressing) - (see prEN 10080)<sup>1)</sup>;
- weldable fine grain structural steel - (see EN 10113 Parts 1 to 3);
- hot finished structural hollow sections - (see EN 10210-1).

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

### 2.1 General standards

EN 10020	<i>Definition and classification of grades of steel</i>
EN 10021	<i>General technical delivery requirements for steel and iron products</i>
EN 10025	<i>Hot-rolled products of non-alloy structural steels — Technical delivery conditions</i>
EN 10027-1	<i>Designation systems for steel — Part 1: Steel names, principal symbols</i>
EN 10027-2	<i>Designation systems for steels — Part 2: Numerical system</i>
prEN 10052 <sup>1)</sup>	<i>Vocabulary of heat treatment terms for ferrous products</i>
EN 10079	<i>Definition of steel products</i>
EN 10163	<i>Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 1. General requirements Part 2: Plate and wide flats Part 3: Sections</i>
EN 10164	<i>Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions</i>
EN 10204	<i>Metallic products — Types of inspection documents</i>
EURONORM 168 (1986) <sup>2)</sup>	<i>Iron and steel products — Inspection documents — Contents</i>
ECISS IC 10	<i>Designation systems for steel — Additional symbols for steel names</i>

### 2.2 Standards on dimensions and tolerances

EN 10029	<i>Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions, shape and mass</i>
EN 10051	<i>Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels — Tolerances on dimensions and shape</i>
prEN 10034 <sup>1)</sup>	<i>Structural steel I and H sections — Tolerances on shape and dimensions</i>

<sup>1)</sup> Draft is under discussion

- prEN 10056-2<sup>1)</sup> *Structural steel equal and unequal leg angles — Part 2 : Tolerances on shape and dimensions*
- EURONORM 19 (1957)<sup>2)</sup> *IPE beams; parallel-flanged beams*
- EURONORM 24 (1962)<sup>2)</sup> *Standard beams and channel sections — Tolerances*
- EURONORM 48 (1984)<sup>2)</sup> *Specification for hot-rolled narrow steel strip — Tolerances on dimensions, shape and mass*
- EURONORM 53 (1962)<sup>2)</sup> *Wide-flanged beams with parallel flanges*
- EURONORM 54 (1980)<sup>2)</sup> *Small hot-rolled steel channels*
- EURONORM 55 (1980)<sup>2)</sup> *Hot-rolled equal flange tees with radiused root and toes in steel*
- EURONORM 56 (1977)<sup>2)3)</sup> *Hot-rolled equal angles (with radiused root and toes)*
- EURONORM 57 (1978)<sup>2)3)</sup> *Hot-rolled unequal angles (with radiused root and toes)*
- EURONORM 58 (1978)<sup>2)</sup> *Hot-rolled flats for general purposes*
- EURONORM 59 (1978)<sup>2)</sup> *Hot-rolled square bars for general purposes*
- EURONORM 60 (1977)<sup>2)</sup> *Hot-rolled round bars for general purposes*
- EURONORM 91 (1981)<sup>2)</sup> *Hot-rolled wide flats — Tolerances on dimensions, shape and mass*

### 3 Definitions

For the purposes of this European Standard the following definitions apply.

**3.1** Alloy special steel as defined in EN 10020.

**3.2** Heat treatment terms as defined in prEN 10052.

**3.3** Long products and flat products (plate, sheet, narrow strip, wide strip and wide flats) as defined in EN 10079.

#### 3.4 normalizing rolling

A rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing. The abbreviated form of this delivery condition is N.

NOTE. In international publications for both the normalizing rolling, as well as the thermomechanical rolling, the expression 'controlled rolling' may be found. However in view of the different applicability of the products a distinction of the terms is necessary

#### 3.5 Steel with improved atmospheric corrosion resistance

A steel in which a certain number of alloying elements, such as P, Cu, Cr, Ni, Mo, ... have been added in order to increase its resistance to atmospheric corrosion, by forming an auto-protective oxide layer on the base metal under the influence of weather conditions.

NOTE 1. Steel with improved atmospheric corrosion resistance is often called weathering steel

NOTE 2. Additional information for the use of steel with improved atmospheric corrosion resistance is given in annex B

### 2.3 Standards on testing

- EN 10002-1 *Metallic materials — Tensile testing — Part 1: Method of test (at ambient temperature)*
- EN 10045-1 *Metallic materials — Charpy impact test — Part 1: Test method*
- EURONORM 18 (1979)<sup>2)</sup> *Selection and preparation of samples and test pieces for steel and iron and steel products*
- EURONORM 103 (1971)<sup>2)</sup> *Microscopic determination of the ferritic and austenitic grain size of steel*
- ISO 2566/1 (1984) *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels*

### 4 Information to be supplied by the purchaser

#### 4.1 General

The following information shall be supplied by the purchaser at the time of enquiry and order:

- details of the product form and relevant quantities;
- reference to this European Standard;
- nominal dimensions and tolerances (see 5.1);
- the grade and quality of steel (see tables 3, 5 and 6);
- whether products have to be submitted to inspection and testing and if inspection and testing is required which type of inspection and which inspection document is required (see 8.1.2);

Where no specific choice is made by the purchaser concerning points a), b), c) and d) the supplier shall refer back to the purchaser.

<sup>2)</sup> Until these EURONORMS are transformed into European Standards, they can either be implemented or reference made to the corresponding national standards, the list of which is given in annex D to this European Standard.

<sup>3)</sup> EURONORM 56 and 57 are added because they contain the nominal dimensions

#### 4.2 Options

A number of options are specified in clause 11. In the event that the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification.

### 5 Dimensions, mass and tolerances

#### 5.1 Dimensions and tolerances

Dimensions and tolerances shall be in accordance with the relevant European Standards and EURONORMS (see 2.2).

#### 5.2 Mass of steel

The calculated mass shall be determined using a volumetric mass of 7,85 kg/dm<sup>3</sup>

### 6 Classification of grades and qualities; designation

#### 6.1 Classification of grades and qualities

This European Standard specifies the steel grades S235 and S355 (see table 1) which differ in their mechanical properties.

These steel grades may be supplied in qualities J0, J2, and K2. Products of grade S355 with quality J2 and K2 are subdivided into two qualities J2G1, J2G2, K2G1 and K2G2 (see 7.2). The qualities differ in weldability and specified impact values (see also 7.5.1).

Grade S355 is subdivided into the classes W and WP, which differ mainly in their carbon and phosphorus contents (see table 3) and availability (see table 2).

#### 6.2 Designation

6.2.1 For the steel grades covered by this European Standard the steel names are allocated in accordance with EN 10027-1 and ECISS IC 10; the steel numbers are allocated in accordance with EN 10027-2

NOTE For a list of corresponding former designations and the former designations from EURONORM 155 (1980) see annex E, table E 1

6.2.2 The designation shall consist of:

- the number of this European Standard (EN 10155);
- the symbol S;
- the indication of the minimum specified yield strength for thickness  $\leq 16$  mm expressed in N/mm<sup>2</sup>,

- the quality designation (see 6.1) in respect to the weldability and specified impact values;
- the letter W indicating that the steel has an improved atmospheric corrosion resistance;
- the letter P for the class with a greater phosphorus content (only in the case of grade S355);
- if applicable, the indication '+N' when the products shall be delivered in the condition N (see 3.4 and table 1)

*Example:* Steel EN 10155 - S355J0W

### 7 Technical requirements

#### 7.1 Steel manufacturing process

7.1.1 The steel manufacturing process shall be at the manufacturer's option. If specified at the time of the enquiry and order the steel manufacturing process shall be reported to the purchaser.

Option 2.

7.1.2 The method of deoxidation shall be as given in table 3.

7.1.3 The deoxidation methods are indicated as follows.

FN Rimming steel not permitted

FF Fully killed steel containing nitrogen binding elements in amounts sufficient to bind the available nitrogen (for example min. 0,020 % Al). If other elements are used they shall be reported in the inspection document.

#### 7.2 Delivery conditions

##### 7.2.1 General

If an inspection document is required (see 8.1.2) and products are ordered and delivered in the condition N this shall be indicated in the document.

##### 7.2.2 Flat products

7.2.2.1 Unless otherwise agreed flat products of qualities J0 shall be supplied in a delivery condition at the manufacturer's discretion (see 7.4.1).

Option 10.

7.2.2.2 Flat products of qualities J2, J2G1 and K2G1 shall be supplied normalized or in an equivalent condition obtained by normalizing rolling as defined in 3.4.

7.2.2.3 Flat products of qualities J2G2 and K2G2 shall be supplied in a delivery condition at the manufacturer's discretion.

### 7.2.3 Long products

**7.2.3.1** Unless otherwise agreed long products of the qualities J0, J2, J2G1 and K2G1 shall be supplied in a delivery condition at the manufacturer's discretion.

Option 14.

**7.2.3.2** Long products of qualities J2G2 and K2G2 shall be supplied in a delivery condition at the manufacturer's discretion.

**7.2.4** The delivery conditions are summarized in table 1.

Grades and qualities	Delivery condition	
	Flat products	Long products
S235J0W	Optional <sup>1)</sup>	Optional <sup>1)</sup>
S235J2W	N	Optional <sup>1)</sup>
S355J0WP	Optional <sup>1)</sup>	Optional <sup>1)</sup>
S355J2WP	N	Optional <sup>1)</sup>
S355J0W	Optional <sup>1)</sup>	Optional <sup>1)</sup>
S355J2G1W	N	Optional <sup>1)</sup>
S355J2G2W	Discretion manufacturer <sup>2)</sup>	Discretion manufacturer <sup>2)</sup>
S355K2G1W	N	Optional <sup>1)</sup>
S355K2G2W	Discretion manufacturer <sup>2)</sup>	Discretion manufacturer <sup>2)</sup>

<sup>1)</sup> Unless otherwise agreed at the time of the enquiry and order delivery condition at the manufacturer's discretion  
<sup>2)</sup> Delivery condition at the manufacturer's discretion.

### 7.3 Chemical composition

**7.3.1** The chemical composition determined by ladle analysis shall comply with the values of table 3.

**7.3.2** The permissible deviations of the product analysis from the specified limits of the ladle analysis are specified in table 4. The product analysis shall be carried out only when specified at the time of the enquiry and order.

Option 3.

**7.3.3** For the grade S355 a carbon equivalent value of max. 0,52 % and for grade S235 a carbon equivalent value of max. 0,44 % for all thicknesses can be agreed at the time of the enquiry and order to be determined on the ladle analysis using the following formula:

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

When a maximum carbon equivalent value has been agreed the content of the elements in the carbon equivalent value formula shall be reported in the inspection document.

Option 4.

Designation		Flat products		Long products	
		Nominal thickness		Sections Shapes	Bars
According EN 10027-1 and ECIS IC 10	According EN 10027-2	mm		mm	
		≤ 12	≤ 100	≤ 40	≤ 100
S235J0W	1.8958		×	×	×
S235J2W	1.8961		×	×	×
S355J0WP	1.8945	×		×	
S355J2WP	1.8946	×		×	
S355J0W	1.8959		×	×	×
S355J2G1W	1.8963		×	×	×
S355J2G2W	1.8965		×	×	×
S355J2G1W	1.8966		×	×	×
S355J2G2W	1.8967		×	×	×



Table 3. Chemical composition of the ladle analysis

Designation	Method of deoxidation	C max. %	Si max. %	Mn %	P %	S max. %	N max. %	Addition of nitrogen binding elements <sup>1)</sup>	Cr %	Cu %	Others
According to EN 10027-1 and ECIS IC 10											
According to EN 10027-2											
S235J0W	FN	0,13	0,40	0,20 - 0,60	max. 0,040	0,040	0,009 <sup>2)5)</sup>	—	0,40 - 0,80	0,25 - 0,55	<sup>3)</sup>
S235J2W	FF	0,13	0,40	0,20 - 0,60	max. 0,040	0,040	—	yes	0,40 - 0,80	0,25 - 0,55	
S355J0WP	FN	0,12	0,75	max. 1,0	0,06 - 0,025	0,040	0,009 <sup>6)</sup>	—	0,30 - 1,25	0,25 - 0,55	<sup>3)</sup>
S355J2WP	FF	0,12	0,75	max. 1,0	0,06 - 0,025	0,035	—	yes	0,30 - 1,25	0,25 - 0,55	
S355J0W	FN	0,16	0,50	0,50 - 1,50	max. 0,040	0,040	0,009 <sup>2)5)</sup>	—	0,40 - 0,80	0,25 - 0,55	<sup>3)4)</sup>
S355J2G1W	FF	0,16	0,50	0,50 - 1,50	max. 0,035	0,035	—	yes	0,40 - 0,80	0,25 - 0,55	
S355J2G2W	FF	0,16	0,50	0,50 - 1,50	max. 0,035	0,035	—	yes	0,40 - 0,80	0,25 - 0,55	
S355K2G1W	FF	0,16	0,50	0,50 - 1,50	max. 0,035	0,035	—	yes	0,40 - 0,80	0,25 - 0,55	
S355K2G2W	FF	0,16	0,50	0,50 - 1,50	max. 0,035	0,035	—	yes	0,40 - 0,80	0,25 - 0,55	

<sup>1)</sup> The steels shall contain at least one of the following elements. Al total  $\geq 0,020$  %, Nb  $\geq 0,015$  to  $0,060$  %, V  $0,02$  to  $0,10$  %, Ti  $0,02$  to  $0,10$  %. If these elements are used in combination, at least one of them shall be present with the minimum of content indicated

<sup>2)</sup> It is permissible to exceed the specified values provided that each increase of  $0,001$  % N the P max content will be reduced by  $0,005$  %; the N content of the ladle analysis, however, shall not be more than  $0,012$  %.

<sup>3)</sup> The steels may show a Ni content of max.  $0,65$  %

<sup>4)</sup> The steels may contain max  $0,30$  % Mo and max  $0,45$  % Zr

<sup>5)</sup> The max. value for nitrogen does not apply if the chemical composition shows a minimum total Al content of  $0,020$  % or if sufficient other N binding elements are present. The N binding elements shall be mentioned in the inspection document.

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